NAME Marking Scheme ADM. NO.________ CL.______

MATHEMATICS

TRIALS PAPER 121/1

September 2022

Time: 2 ½ Hours

ALLIANCE HIGH SCHOOL

Kenya Certificate of Secondary Education (K.C.S.E)

INSTRUCTIONS TO CANDIDATES

1. Write your name and Admission number in the space provided at the top of this page.
2. The paper contains **TWO** sections; section I and section II
3. Answer **ALL** the questions in Section I and Only Five questions in Section II
4. Show all the steps in your calculations; giving your answers at each stage in the spaces provided below each question.
5. Marks may be given for correct working even if the answer is wrong.
6. Non-programmable silent electronic calculators and KNEC mathematical tables maybe used.

For Examiners use only

Section 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
A	A	A	A	B	B	B	C	C	C	D	D	D	G	G	G	

Section II

17	18	19	20	21	22	23	24	Total
K	K	M	M	Q	Q	R	R	

Grand Total

This paper consists of 14 printed pages

Candidates should check the question paper to ensure that all the printed pages are printed as indicated and no questions are missing.

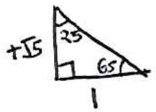
SECTION 1 (50 marks) Answer ALL the questions in the spaces provided.

1. Evaluate correct to 4 significant figures; (3mks)

$$\frac{4 X 6 + \frac{1}{25} \div 0.05 + \frac{1}{5}}{(-3) \div (-6) + (23) - 6 \text{ of } 3}$$

$$\frac{24 + 0.8 + \frac{1}{5}}{0.5 + 23 - 18} = \frac{25}{5.5} \checkmark = 4.545 \checkmark$$

2. Given that $Tan\ 65^0 = 3 + \sqrt{5}$, determine without using mathematical tables nor calculator, $Tan\ 25^0$, leaving your answer in the form $a + b\sqrt{c}$, where a, b, and c are rational numbers. (3mks)



$$Tan\ 25 = \frac{1}{3+\sqrt{5}} \times \frac{3-\sqrt{5}}{(3-\sqrt{5})}$$

$$= \frac{3-\sqrt{5}}{9-5} = \frac{3-\sqrt{5}}{4} = \frac{3}{4} - \frac{1}{4}\sqrt{5}$$

3. Use mathematical tables to find y, correct to four significant figures. (4mks)

$$\frac{1}{y} = \frac{1}{24.3} + \frac{1}{13.1}$$

rec 24.3 = 0.04115

13.1 = 0.07634

$\frac{1}{y} = 0.04115 + 0.07634$

$\frac{1}{y} = 0.11749$

$y = \frac{1}{0.11749}$ ✓ A1

rec 0.11749

$y = 8.509$ ✓ A1

4. The three sides of a right angled are $(x-1)$, $(2x+8)$ and the hypotenuse $(3x+1)$, find the area of the triangle. (3mks)

$(3x+1)^2 = (x-1)^2 + (2x+8)^2$

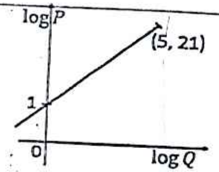
$9x^2 + 6x + 1 = x^2 - 2x + 1 + 4x^2 + 32x + 64$

$4x^2 - 24x - 64 = 0$

$x = -2$ or 8 ✓

Area $= \frac{1}{2} \times 7 \times 24 = 84$ sq units

5. The figure below shows the graph of $\log P$ against $\log Q$.



$a = 10$

gradient $= n$

$\frac{21-1}{5-0} = 4$

Given that $P = aQ^n$, find the values of a and n. (3mks)

$\log P = \log a + n \log Q$

$\log a = 1$

$10^1 = a$

6. A salesman is paid a salary of Sh. 10,000 per month. He is also paid a commission on sales above Sh. 100,000. If in one month he sold goods worth Sh. 500,000 and his total earnings amounted to Sh. 56,000. Calculate the rate of commission. (3mks)

Commission $= 56{,}000 - 10{,}000$
$= 46{,}000$

$46000 = 400{,}000 \times \frac{r}{100}$

$r = 11.5\%$

7. Solve the following equation, giving your answer correct to 4 decimal places. (3mks)

$8^x + 5 + 2^{3x} = 35$

$2^{3x} + 2^{3x} = 30$

let $2^{2x} = y$

$2y = 30$

$y = 15$

$2^{2x} = 15$

$\log 2^{2x} = \log 15$

$2x = \frac{\log 15}{\log 2}$

$x = 1.953$

8. Express in surd form and simplify by rationalizing the denominator; (3mks)

$$\frac{1 + \cos 30^0}{1 - \sin 60^0}$$

$\frac{1+\frac{\sqrt{3}}{2}}{1-\frac{\sqrt{3}}{2}} \cdot \frac{\left(1+\frac{\sqrt{3}}{2}\right)}{\left(1+\frac{\sqrt{3}}{2}\right)} = \frac{1+\sqrt{3}+\frac{3}{4}}{1-\frac{3}{4}}$

$= \frac{\frac{7}{4}+\sqrt{3}}{\frac{1}{4}} = 7+4\sqrt{3}$

9. Solve; $4 \leq 3x - 2 < 9 + x$

Hence list all the integral values that satisfy the inequality. (3mks)

$4 \leq 3x - 2$ $\quad$ $3x - 2 < 9 + x$

$6 \leq 3x$ $\quad$ $2x < 11$

$2 \leq x$ $\quad$ $x < 5.5$

$2 \leq x < 5.5$

$x = 2, 3, 4$

10. Simplify the expression; (3mks)

$$\frac{6b - 3ab - 2a + a^2}{a^2 - 9b^2}$$

Num $= 3b(2-a) - a(2-a)$
$= (3b-a)(2-a)$

den $= (a-3b)(a+3b)$

$\frac{-1(\cancel{-3b+a})(2-a)}{(\cancel{a-3b})(a+3b)}$

$= \frac{a-2}{a+3b}$

11. A construction company employs technicians and artisans. On a certain day 3 technicians and 2 artisans were hired and paid a total of ksh 9000. On another day the firm hired 4 technicians and 1 artisan and paid a total of ksh 9,500. Calculate the cost of hiring 2 technicians and 5 artisans in a day. (3mks)

$3t + 2a = 9000$

$4t + 1a = 9500$

$3t + 2(9500 - 4t) = 9000$

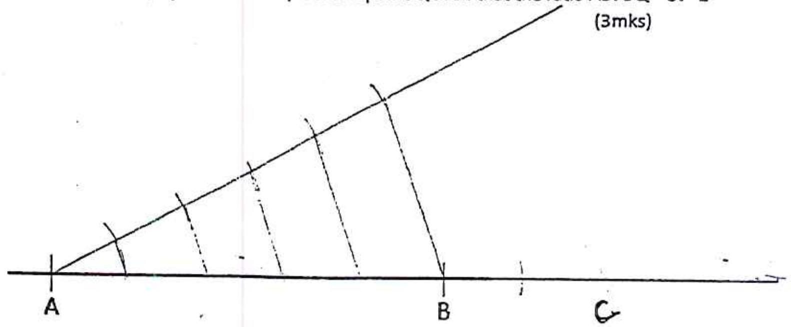
$-5t = -10000$

$t = 2000$ $\quad$ $a = 1500$

$2(2000) + 5(1500)$

$= 11{,}500$ shs.

12. On the line provided below, by construction, locate a point Q such that the ratio AB: BQ = 5: −2 (3mks)



… that $\log 7 = 0.8451$ and $\log 6 = 0.7782$, find $\log 25.2$ (3mks)

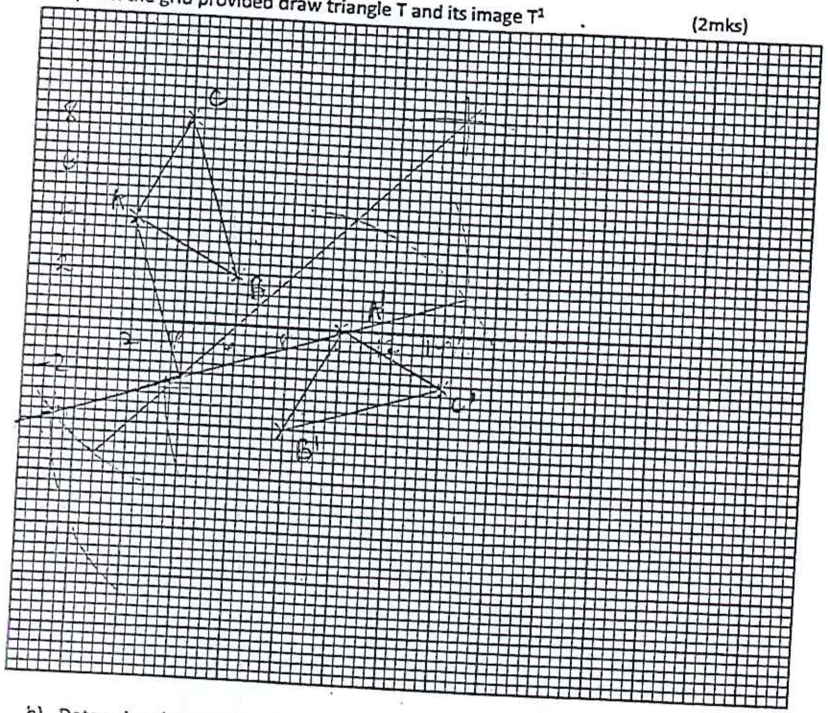
$\log \frac{6^2 \times 7}{10}$

$= 2\log 6 + \log 7 - \log 10$

$2(0.7782) + 0.8451 - 1 = 1.4015$

14. A triangle T with vertices A (2,4), B (6,2) and C (4,8) is mapped onto a triangle T¹ with vertices A' (10, 0), B' (8, −4) and C' (14, −2) by a rotation.

a) On the grid provided draw triangle T and its image T¹ (2mks)



b) Determine the centre and angle of rotation that maps T onto T¹. (2mks)

$(4, -2)$, -90°

15. Velocity of a particle moving on a straight line is given by $V = (2t + 10)\ ms^{-1}$, where t is the time taken in seconds. Find the distance covered in the 3rd second. (3mks)

$S = \int 2t + 10\ dt$

$= t^2 + 10t + c$

$t = 0\ s = 0$, therefore $c = 0$

$s = t^2 + 10t$

$3^2 + 10(3) = 39$

$S = \int_2^3 2t + 10\ dt$

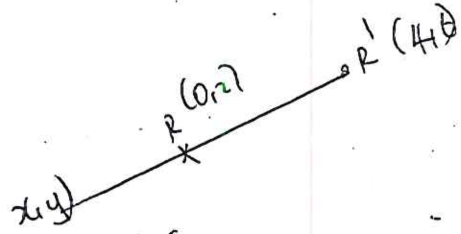
$\left[t^2 + 10t + c\right]_2^3$

$(3^2 + 10(3) + c) - (2^2 + 10(2) + c)$

$(39 + c) - (24 + c)$

15

16. A point R (0, 2) has its image R' (4, 6) under an enlargement with scale factor 3. Find, without drawing, the centre of enlargement. (3mks)



$\frac{6-y}{2-y} = 3$

$6 - y = 6 - 3y$

$y = 0$

$\frac{4-x}{0-x} = 3$

$4 - x = -3x$

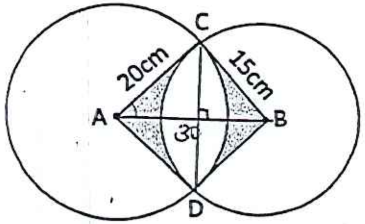
$4 = -2x$

$-2 = x$

$(-2, 0)$

SECTION II (50 marks) **Answer only five questions from this section in the spaces provided.**

17. The diagram below shows two intersecting circles of radii 20cm and 15cm such that their centres A and B are 30cm apart.



Calculate to 2 decimal places;

a) The area of the sector ACD (3mks)

$15^2 = 30^2 + 20^2 - 2(30)(20)\cos\theta$

$\theta = 26.38$

CAD = 52.77

$\frac{52.77}{360} \times \frac{22}{7} \times 20^2 = 184.28$

b) The area of sector BCD (3mks)

$20^2 = 15^2 + 30^2 - 2(15)(30)\cos\theta$

$\theta = 36.34$

CBD = 72.68

$\frac{72.68}{360} \times \frac{22}{7} \times 15^2 = 142.76$

c) The length of the chord CD (2mks)

$\sin 52.77 = \frac{x}{20}$

$x = 15.92$

$15.92 \times 2 = 31.84$

d) The area of the quadrilateral ABCD (1mk)

$(\frac{1}{2} \times 20 \times 20 \sin 52.77) + (\frac{1}{2} \times 15 \times 15 \sin 72.68)$

266.64

e) The shaded area (1mk)

$266.64 - (184.28 + 142.76 - 266.64)$

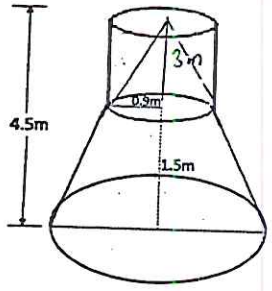
$= 206.24$

18. A solid S is made up of a frustrum of a cone whose upper part is replaced with cylindrical part. The height of the solid is 4.5m, the common radius of the cylindrical part and the conical part is 0.9m, and the height of the conical part is 1.5m.

Taking π as $\frac{22}{7}$,

a) Calculate, correct to 1 decimal place,

(i) The volume of solid S. (4mks)



$\frac{4.5}{3} = \frac{r}{0.9}$

$r = 1.35$

$(\frac{1}{3} \times \frac{22}{7} \times 1.35^2 \times 4.5 - \frac{1}{3} \times \frac{22}{7} \times 0.9^2 \times 3)$

$= 6.046$

$\frac{22}{7} \times 0.9^2 \times 3 = 7.637 \simeq 7.6$

(ii) The total surface area of solid S (4mks)

$\frac{22}{7} \times 1.35^2 = 5.728$

$\frac{22}{7} \times 0.9^2 = 2.546$

$\frac{22}{7} \times 2 \times 0.9 \times 3 = 16.97$

$L = \sqrt{1.35^2 + 4.5^2} = 4.698$

$l = \sqrt{0.9^2 + 3^2} = 3.132$

$\frac{22}{7} \times 1.35 \times 4.698 - \frac{22}{7} \times 0.9 \times 3.13$

$= 11.074$

Total surface area

$5.728 + 2.546 + 16.97 + 11.074$

$= 36.318 \simeq 36.3$

b) A square based pillar of side 1.6m has the same volume as solid S. Determine the height of the pillar, correct to 1 decimal place. (2mks)

$1.6 \times 1.6 \times h = 7.6$

$h = 2.968$

$\simeq 3.0$

19. A bus left Mombasa and travelled towards Machakos at an average speed of 60km/h. After $2\frac{1}{2}$ hours, a car left Mombasa and travelled along the same road at an average speed of 100km/h. If the distance between Mombasa and Machakos is 500km, determine:

a) (i) The distance of the bus from Machakos when the car took off. (2mks)

$500 - (60 \times 2.5)$

$= 350km.$

(ii) The distance the car travelled to catch up with the bus. (4mks)

$t = \frac{150}{40} = 3\frac{3}{4}$ hrs

$d = 100 \times 3\frac{3}{4} = 375Km$

b) Immediately the car caught up with bus, the car stopped for 25min. find the new average speed at which the car travelled in order to reach Machakos at the same time as the bus. (4mks)

$t = \frac{125}{60} = 2$hrs 5min

2 hrs 5 min
− 25min
1hr 40 min = $1\frac{2}{3}$hrs

$s = \frac{125}{1\frac{2}{3}} = 75$ Km/h.

20. (a) Given that $a = \begin{pmatrix}4\\3\end{pmatrix}$, $c = \begin{pmatrix}-2\\-5\end{pmatrix}$ and $3a - 2b + 4c = \begin{pmatrix}10\\-19\end{pmatrix}$ find b. (3mks)

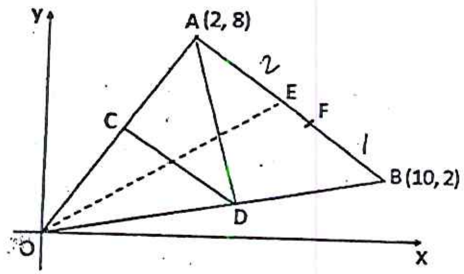
$3\begin{pmatrix}4\\3\end{pmatrix} - 2\begin{pmatrix}x\\y\end{pmatrix} + 4\begin{pmatrix}-2\\-5\end{pmatrix} = \begin{pmatrix}10\\-19\end{pmatrix}$

$\begin{pmatrix}12\\9\end{pmatrix} - \begin{pmatrix}2x\\2y\end{pmatrix} - \begin{pmatrix}8\\+20\end{pmatrix} = \begin{pmatrix}10\\-19\end{pmatrix}$

$\begin{pmatrix}2x\\2y\end{pmatrix} = \begin{pmatrix}-6\\8\end{pmatrix}$

$b = \begin{pmatrix}-3\\4\end{pmatrix}$

b) In the figure below, OAB is a triangle. A is the point (2, 8) and B the point (10, 2). C, D, and E are the mid-points of OA, OB, and AB respectively, while F is on AB such that $AF = \frac{2}{3}AB$



i. Find the position vectors of point C (2mks)

$OC = \frac{1}{2}\begin{pmatrix}2\\8\end{pmatrix} = \begin{pmatrix}1\\4\end{pmatrix}$

ii. Find the length of vector AB (3mks)

$AB = \begin{pmatrix}10\\2\end{pmatrix} - \begin{pmatrix}2\\8\end{pmatrix} = \begin{pmatrix}8\\-6\end{pmatrix}$

$|AB| = \sqrt{8^2 + (-6)^2} = 10$

iii. If vector OA = a and vector OB = b, write DF in terms of vectors a and b (2mks)

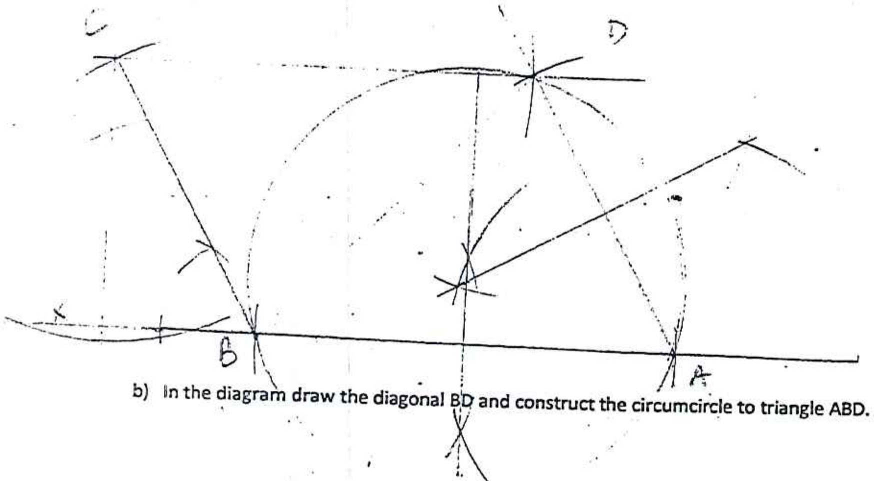
$DF = DB + BF$

$= \frac{1}{2}b + \frac{1}{3}(a - b)$

$\frac{1}{2}b + \frac{1}{3}a - \frac{1}{3}b$

$\frac{1}{6}b + \frac{1}{3}a.$

21. (a) Using a ruler and a pair of compasses construct a parallelogram ABCD, where AB = 8cm, BC = 6cm and angle ABC = 120^0. (3mks)



b) In the diagram draw the diagonal BD and construct the circumcircle to triangle ABD. (3mks)

c) Construct a perpendicular from C to meet AB produced at X. Measure CX. (2mks)

5.2 ± 0.1

d) Calculate the area of triangle ACD. (2mks)

$\frac{1}{2} \times 5.2 \times 8 = 20.8\ cm^2$

22. Mr. Pesa bought two types of items from a wholesaler. He bought 5 of type A at Ksh. 1,250 each and 20 of type B at Ksh. 650 each. He is to sell these items at a retail price of Ksh, 1,400 for each item of type A and Ksh. 700 for each of type B.

a) Find the total expenditure of Mr. Pesa. (2mks)

$(1250 \times 5) + (650 \times 20) = 19,250$

b) Assuming that Mr. Pesa sold all the items, calculate his percentage profit, to 1 decimal place. (3mks)

$S.P = (1400 \times 5) + (700 \times 20) = 21000$

$\frac{1750}{19250} \times 100 = 9.09$

$\simeq 9.1\%$

c) Mr. Pesa learned of a new variety of the same items of type A and type B and decided to return the remaining stock in exchange for the new variety. The remaining stock consisted of one item of type A and 10 of type B. The prices of the new variety were Ksh. 1,500 and Ksh. 800 of type A and B respectively. If Mr. Pesa bought the same number of items as before;

(i) What was the value of the returned goods if a depreciation of 10% is allowed? (3mks)

Returned $(1 \times 1250) + (10 \times 650) = 7750$

$7750\left(1 - \frac{10}{100}\right) = 6975$

(ii) Find how much money he was to add in order to get the new variety? (2mks)

$(1500 \times 5) + (800 \times 20) = 23500$

$- 6975$

$16,525$

23. Triangle ABC has vertices $A(-2,0)$, $B(-5,3)$, $and\ C(1,3)$.

a) Find the coordinates of a point O that is equidistant from points A, B, and C (5mks)

grad AB

$\frac{3-0}{-5+2} = \frac{3}{-3} = -1$

$\left(\frac{-2+-5}{2}, \frac{0+3}{2}\right)$

$(-3.5, 1.5)$

Perpendicular bisector AB

$\frac{y-1.5}{x+3.5} = 1$

$y - 1.5 = x + 3.5$

$y = x + 5$

grad BC

B

perpendicular bisector BC

$= x = -2$

$y = x + 5$

$x = -2$

$y = -2 + 5$

$= 3$

$O = (-2, 3)$.

b) If the triangle is circumscribed, find the equation of the circumcircle in the form; $ax^2 + by^2 + cx + dy + k = 0$, $where\ a, b, c, d, and\ k\ are\ constants.$ (2mks)

Centre $(-2, 3)$

$(1+2)^2 + (3-3)^2 = r^2$

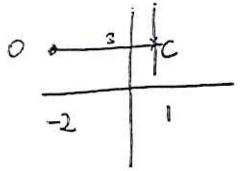
$r^2 = 9$

$(x+2)^2 + (y-3)^2 = 9$

$x^2 + 4x + 4 + y^2 - 6y + 9 = 9$

$x^2 + y^2 + 4x - 6y + 4 = 0$

c) Determine the equation of the tangent to the circle at point C, in the form of y = mx + c (3mks)

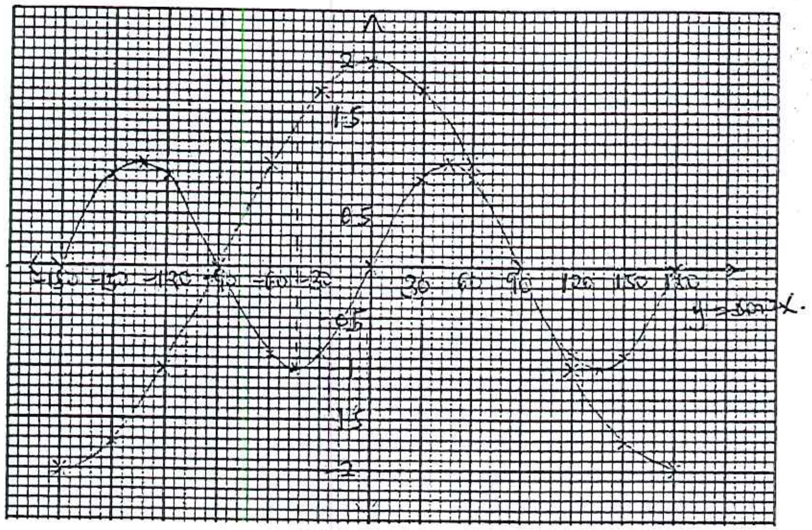


equation of tangent $x = 1$

24. (a) Complete the table below for the functions $y = 2Cos\ x$ and $y = Sin\ 2x$, for $(-180^0 \leq x \leq 180^0)$ (2mks)

x	-180	-150	-120	-90	-60	-30	0	30	60	90	120	150	180
$2x$	-360	-300	-240	-180	-120	-60	0	60	120	180	240	300	360
$2\cos x$	-2	-1.73	-1	0	1	1.73	2	1.73	1	0	-1	-1.72	-2
$\sin 2x$	0	0.87	0.87	0	-0.87	-0.87	0	0.87	0.87	0	-0.87	-0.87	0
		1			-1.			1			-1		

b) On the grid provided, draw on the same axis the graphs of $y = 2Cos\ x$ and $y = Sin\ 2x$, for $(-180^0 \leq x \leq 180^0)$ (4mks)



c) Use the graphs in (b) above to determine;

i. The amplitude and period of the graph $y = 2Cos\ x$ (2mks)

Amplitude = 2

Period = 360

ii. The values of x such that; $2Cosx - Sin\ 2x = 0$ (1mk)

$x = -90$ or 90

iii. The difference in the values of y when $x = -45^0$ (1mk)

2.4.